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ORIGINAL ARTICLE

A European training system in cardiothoracic surgery: is it time?

Mahmoud Loubani[a,*], Justo Rafael Sadaba[b], Patrick O. Myers[c], Neil Cartwright[d], Matthias Siepe[e], Maximilian Y. Emmert[f], David J. O'Regan[d], Peter Krieg[g] and Paul T. Sergeant[h]

[a] Department of Cardiothoracic Surgery, Castle Hill Hospital, Hull, UK
[b] Department of Cardiac Surgery, Hospital de Navarra, Pamplona, Spain
[c] Department of Cardiac Surgery, Children's Hospital Boston and Harvard Medical School, Boston, MA, USA
[d] Department of Cardiac Surgery, Leeds General infirmary, Leeds, UK
[e] Department of Cardiovascular Surgery, Medical University Clinic, Freiburg, Germany
[f] Department of Cardiac and Vascular Surgery, University Hospital Zurich, Zurich, Switzerland
[g] Department of Cardiothoracic Surgery, Friedrich-Schiller-University Jena, Jena, Germany
[h] Department of Cardiac Surgery, Gasthuisberg University Hospital, Leuven, Belgium

*Corresponding author. Department of Cardiothoracic Surgery, Castle Hill Hospital, Cottingham, HU16 5JQ, UK. Tel: +44-1482-624379; E-mail: mahmoud.loubani@hey.nhs.uk (M. Loubani).

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Abstract

OBJECTIVE: Training in cardiothoracic surgery across Europe remains diverse and variable despite the ever closer integration of European countries at all levels and in all areas of life. Coupled with the increasing ease of movement across Europe, the need for uniform training programmes has arisen to allow for equivalent accreditation and certification.

METHODS: We review the current training paradigms within the specialty across the world and in Europe and also explore the concept of competence.

RESULTS: There are diverse training systems across the world and in Europe in particular. Competence-based training is the new model of training; however, competence remains difficult to define and measure. We propose a European Training Programme in Cardiothoracic Surgery that aims to standardize training across the European countries.

CONCLUSIONS: The difficulties in unifying training across Europe are numerous, but it is time to implement a European Training System in Cardiothoracic Surgery that will deliver a competence-based curriculum.

Keywords: Cardiothoracic • Training • Europe • Competence

INTRODUCTION

The lack of uniformity in the training of cardiothoracic surgery across Europe was recently highlighted by a survey of training conducted by the Surgical Training and Manpower Committee of the European Association for Cardiothoracic Surgery [1]. It highlighted the wide variation in the structure and availability of training in Europe, ranging from well-structured programmes in some countries to none in others, with a lack of agreed or specified standards to identify the completion of training in cardiothoracic surgery across Europe.

The aim of this paper is to review the current training paradigms and to outline a uniform training system in Europe with clear entry and completion criteria, which aims to improve and streamline training in cardiothoracic surgery in Europe by establishing a competency-based training system. This system would allow the delivery of a curriculum of training in cardiothoracic surgery with explicit competencies in knowledge, clinical skills and professional abilities.

TRAINING PROGRAMMES

Surgical training has always been based on an apprenticeship model, with surgical trainees learning their skills from experienced surgeons by spending an unspecified number of years under supervision. Halsted changed the training of surgeons from a disorganized apprenticeship to the residency programme model used today in the USA [2], providing clear entry, and progression and graduation criteria from the programme.

The current established training systems across the world have in common only the fact that they are structured. The integrated advanced training programme in cardiothoracic surgery in Australia and New Zealand is 6 years in duration, with two of these years being devoted to general surgery, preferably during the first 3 years. The trainees are expected to have completed a training programme in general surgery and have obtained their Fellowship of the Royal Australian College of Surgeons prior to embarking on a fellowship of training in cardiothoracic surgery of 4 years in duration.

Historically, cardiac surgeons in Canada completed general surgery followed by a fellowship in cardiovascular, cardiothoracic or cardiovascular thoracic surgery. During the 1990s, the Canadian cardiac surgery training programmes changed to 6-year programmes with a direct entry following medical school. Although there is the loss of the chance to acquire general surgery skills prior to embarking on a career in cardiac surgery, this programme allows for training in topics more pertinent to cardiac surgery, such as echocardiography, coronary care and cardiac pathology.

Contemporary Canadian candidates completing general surgery and wishing to pursue cardiac surgery often complete a cardiothoracic surgery fellowship in the USA. However, the Royal College of Physicians and Surgeons of Canada offers a 3-year cardiac surgery fellowship for qualified general surgeons.

Cardiac surgery training in the USA is combined with thoracic surgery. Cardiothoracic surgeons in the USA first complete a general surgery residency (5 years, with two additional research years between the second and third clinical years), followed by a cardiothoracic surgery fellowship. The fellowship typically spans 2 or 3 years, but the board eligibility is based on a 'graduation seal of approval' by the programme director and the number of operations self-reportedly performed as the operating surgeon, not the time spent in the programme. Certification is based on passing rigorous board examinations.

Following a marked reduction in applications and the filling rate of approved training positions in the USA, the American Board of Thoracic Surgery dropped its requirement of board-certification in general surgery and approved integrated 6-year cardiothoracic residency programmes. Applicants are matched into these programmes directly out of medical school, and they have been consistently filled completely since their introduction.

The UK has one of the most established training programmes in Europe. Medical school graduates complete 2 years as foundation doctors prior to competitive entry into 2-year core surgical training in general surgery and complete the Membership of one of the Royal College of Surgeons. This is followed by competitive entry at a national selection process into a competence-based training programme of cardiothoracic surgery. The trainees have to complete all the required competencies as well as successfully completing the Fellowship of the Royal Colleges of Surgeons in Cardiothoracic Surgery examination before being awarded a Certificate of Completion of Training in Cardiothoracic Surgery. It is anticipated that it will take most trainees 6 years to complete the programme. It is however not without deficiencies, most notably the lack of specified methods of delivery and implantation structure of the curriculum.

Structured training programmes in the USA, Canada, Australia and the UK aim to deliver cardiothoracic surgical training, with progression based on formal annual assessments and much shorter training times [3]. This limit on the number of years spent in training, coupled with the introduction of work-hour restrictions on both sides of the Atlantic, such as the European Working Time Directive across the European Union, reducing the number of hours a trainee can work to 56 h initially and then to 48 h since August 2009, or the 80 h work week in the USA, has raised significant concerns regarding the adequacy of surgical training to produce fully trained and qualified surgeons [1, 4] in a much shorter time than in the apprenticeship model. Jackson and Tarpley [5] concluded that shortening of the training hours per week and overall training period to the current levels would have a significant detrimental impact on surgical trainees' competence and the ability at the completion of training. This is reinforced by recent evidence form Schijven *et al.* [6] demonstrating a significant difference in outcomes between 21 practice-ready candidate surgeons from Canada and Holland on Patient Assessment and Management Examination, which focuses on the skills needed to manage patients with complex problems. The main difference between the two groups being the length of hours spent during training. On the other hand, the authors [6] also conclude that there was no difference in cognitive knowledge or technical skills and that there were cultural differences in the assessment.

The apprenticeship model, with long hours and years with no defined end or competence assessment, had rightly been criticized. The reality of this training in the past was that trainees had a very short period of technical training in a specific procedure, typically coronary artery bypass graft (CABG) and were then left 'to get on with it'. Trainees ended up with many hundreds of CABGs, a few aortic valves and very few mitral valve operations, learning by their mistakes with patients suffering. Nevertheless, the introduction of working-hour restrictions can indeed reduce the exposure of trainees to surgical cases as was shown by Sádaba and Urso [7] in a best evidence topic published recently. However, they also demonstrate that with the appropriate changes in the rotas, exposure can actually increase. This review also showed that duty-hour restrictions have lead, in some cases, to improvement in the results of written assessments. One of the changes to improve training opportunities may be to limit the amount of time trainees spend providing service cover for postoperative care in intensive care units, especially if they receive a dedicated period of training in this field during their training. Furthermore, the Specialty Advisory Committee for Cardiothoracic Surgery in the UK has stated that training can be accomplished in an average 48-h week if the focus is on training with a maximum use of training opportunities.

COMPETENCE

Training programmes using specified targets of competence as the basis for progression, such as the Intercollegiate Surgical Curriculum Programme in the UK [8], might arguably go some of the way to resolve the concerns of time-limited models for higher specialist training. However, this detailed curriculum in all areas of practice of a specialty, with the requirement to achieve competence at all levels as the basis for readiness for independent practice, can only be effective and successful if based on a comprehensive and accurate assessment of all aspects of competence.

Harvey [9] defines competence as 'the acquisition of knowledge, skills and abilities at a level of expertise sufficient to be able to perform in an appropriate work setting', while Wojtczak [10] refers to it as 'the possession of a satisfactory level of relevant knowledge and acquisition of a range of relevant skills that include interpersonal and technical components at a certain point in the educational process'. He acknowledges that 'competence may differ from "performance", which denotes actions taken in a real life situation'. This is obviously the same concept proposed by Miller [11] in his pyramid of competence, but he adds that competence does not only involve knowing, but also the recognition when a person does not know and accepts their limits.

Measurement of competence is complex and 'the more experienced the professional being tested, the more difficult it is to create a tool to assess their actual understandings and the complex skills of the tasks they undertake'. Wojtczak [10] proposed a generic model 'where competence is not necessarily directly observable, but rather can be inferred from performance' such as outcomes in terms of patient satisfaction, improvement in symptoms, morbidity and mortality. However, 'competence itself is only of value as a prerequisite for performance in a real clinical setting and does not always correlate highly with performance in practice' [10]. Furthermore, the difficulty in assessing the competence of doctors is compounded by the argument that it is competencies in completing a certain skill or task that is being assessed rather than competence in performing the whole task or competence of the person. Competency 'is a narrower, more atomistic concept used to label particular abilities or episodes'. [12] Therefore, the distinction is that while competence 'refers to the evaluation of persons', competency actually 'refers to activities' [12].

However, Smith [12] admits that the difference is not so clear in practice and that 'competence as a fully human attribute, has been reduced to competencies – a series of discrete activities that people possess the necessary skills, knowledge and understanding to engage in effectively'. However, he accepts that 'in order to measure' competence, 'things have to be broken down into smaller and smaller units. The result is often long lists of trivial skills'. The concern here is that this process 'can lead to a focus on the parts rather than the whole; on the trivial, rather than the significant. It can lead to an approach to education and assessment which resembles a shopping list. When all the items are ticked, the person has passed the course or has learnt something. The role of overall judgment is sidelined' [12].

The natural environment for teaching and assessing surgical skills has always been the operating theatre. However, a number of factors have led to the search for alternative methods. These factors, as identified by Hamstra and Dubrowski [13], include the increasing emphasis with political and financial pressures on meeting the surgical and waiting list targets. This resulted in the challenge of providing trainees with sufficient time to learn surgical skills. Another factor is the justified concern revolving around the ethics of teaching or assessing basic surgical skills on a patient, especially in the face of the increasing scepticism and assertiveness of patients as well as the increasing scrutiny and public reporting of outcomes in our specialty. Furthermore, surgical training is hindered by the increased complexity and co-morbidity of patients with surgical problems that require the skill of experts working at the maximum efficiency, and finally the increasingly complex technical innovations in surgery from emerging technology that requires the attainment of proficiency prior to clinical application. Simulation has been repeatedly [14] shown to provide an alternative for trainees in the early stages of training needing practice to perfect techniques but also for more experienced surgeons to maintain competence in certain skills and learn new ones using simple low-fidelity simulators. Furthermore, newly developed simulation suites and high-fidelity simulators can allow the practice of various emergency situations and improve teamworking and communication skills.

The assessment of performance in the operating theatre has been shown to be difficult. Most methods of evaluating the technical competence of surgical residents have been suggested to be subjective and potentially unreliable [15]. An effective assessment should be based on the five principles as described by Hayes *et al*. [16], which includes validity, reliability, feasibility, acceptability and educational impact.

PROPOSAL FOR A EUROPEAN TRAINING SYSTEM

The training programme would be modular, with progress being competence-based allowing for differentiated learning and instruction [17]. Differentiated learning allows for different trainees to learn at different pace due to varying learning abilities and styles. However, some element of time limit has to be included as the training cannot continue indefinitely in the aim of obtaining competence.

Entry into the training programmes would be competitive and preferably centralized by each national state to allow for standardization of the process. The processes for the selection of trainees in cardiothoracic surgery in Europe are heterogeneous. In some countries, selection is up to the personal preference of the heads of academic departments. It is not unusual to see potential trainees working as 'non-training residents' for a number of years before they can be selected for a training position. In others, it is based on the results obtained in national and hardly relevant multiple choice question examinations. Finally, there are programmes in which selection depends on a number of aspects such as surgical examinations, personal interviews, references etc. Nevertheless, in the majority of cases, the methods used for selecting cardiac surgical trainees are inappropriate to identify some important attributes and skills required in a surgical trainee to be. These fail to measure qualities such as manual dexterity, complex problem solving ability, willingness to work in or lead a team, ability to take responsibility, commitment, communication skills etc. [18]. Academic achievements reflect theoretical knowledge; however, they do not ensure that the candidate can apply this knowledge in practice. Furthermore, the development of new surgical approaches, such as minimally invasive techniques and endoluminal therapies, requires mastering unique psychomotor skills.

Manual skill proficiency is not currently employed in selecting residents for surgery training programmes in most countries, with the exception of the UK. Nevertheless, neuropsychological factors such as visuospatial organization, stress tolerance and psychomotor abilities have been shown to predict operative skills among general surgery residents [19]. In a recent study, non-academic background data such as high-performance accomplishments in performing arts or collegiate athletics was an independent predictor of resident success in general surgery [20]. The ability to work in a team has been shown to be amenable to the objective rating of skills representative of assertiveness, decision-making, situation assessment, leadership and communication [21]. The time and resources spent in the selection processes would help to choose those candidates who are more likely to effectively progress through a surgical training programme.

Cardiac and thoracic surgical specialties are taught and practiced differently across Europe. Cardiac and thoracic surgery are is grouped together in some European countries, but in others they are independent from each other. In other countries, cardiac surgery is grouped together with vascular surgery (cardiovascular surgery) and thoracic surgery is part of the general surgery specialty.

The proposed programme has been designed assuming that cardiac and thoracic surgery are integrated into one specialty for the purpose of training, accreditation and practice, but it could be adapted to any of the described situations.

The programme is split into two parts, as shown in Fig. 1, basic and advanced cardiothoracic surgical training. The basic training delivers basic modules in cardiac surgery, thoracic surgery, paediatric cardiac surgery and intensive care. These modules would be completed ideally in 3 years, with a limit of 4 years. These modules will also include management of cardiology and respiratory medicine as well as the principles of perfusion. At the end of this period, trainees who achieve all required competencies will be awarded a Certificate of Completion of Basic Training in Cardiothoracic Surgery. Any trainee following the completion of this training can then apply for advanced cardiothoracic surgical training which comprises a period of 3 years ideally, with a limit of 4 years, of either cardiac, thoracic or paediatric surgery delivering advanced modules 1, 2 and 3. This advanced training is deliberately separated from the basic training, as not all institutions would be expected to be able to host both, and allows the development of truly suitable training programmes. It is envisaged that a trainee could complete the basic training in one region and move to another for the advanced training or even to a different European country that offers the advanced training they require. Furthermore, trainees not deemed suitable to enter advanced training and acquire the European Certificate of Completion of Cardiothoracic Training can, by achieving the basic training certificate, work within departments under supervision, without the possibility of independent practice. The European Board of Thoracic and Cardiovascular Surgery examination will have to be successfully undertaken near the end of the training period. This examination has only been made a requirement in Switzerland; however, it can easily be made part of the qualifications to complete training across Europe. The Board examination is envisaged to be completed in the last year of training as an exit examination. Trainees in the proposed system will qualify in either adult cardiac, adult thoracic or congenital cardiac surgery. However, trainees wishing to practice cardiothoracic

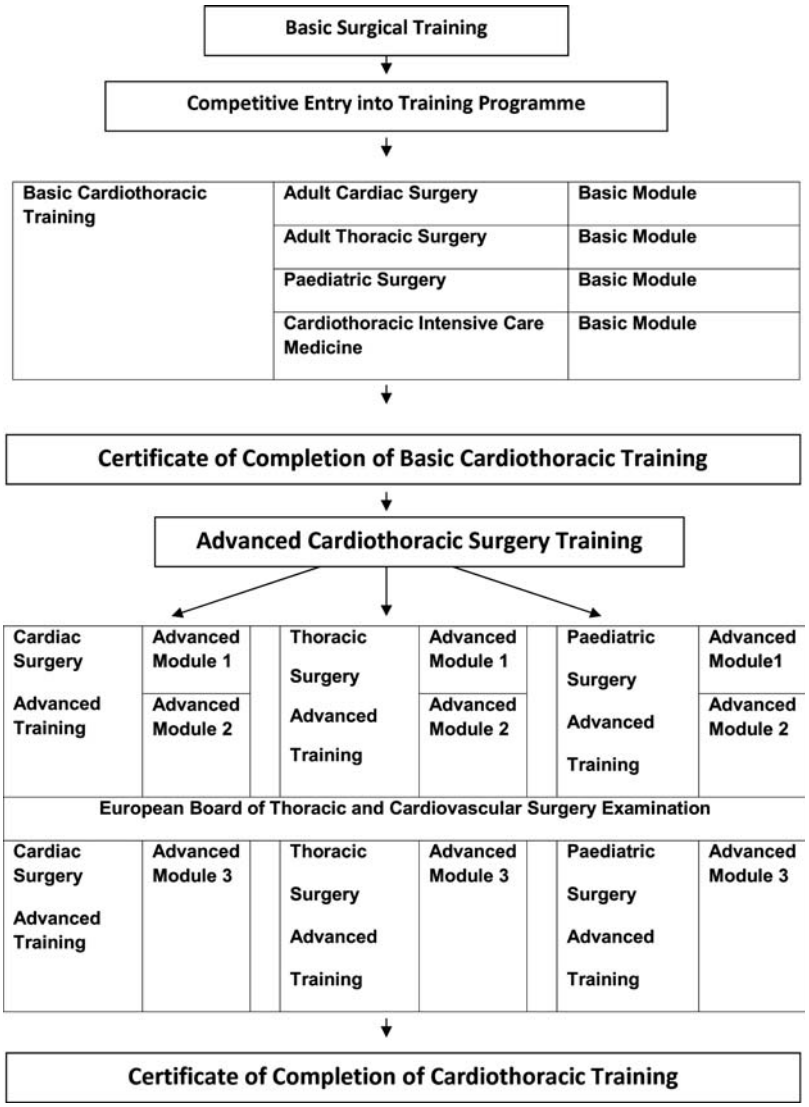

Figure 1: The proposed programme has been designed assuming that cardiac and thoracic surgery are integrated into one specialty for the purpose of training, accreditation and practice, but it could be adapted to any other situation such as cardiovascular surgery.

or adult and congenital cardiac surgery would have to complete both relevant advanced modules of training and also the relevant examinations. Fellowships can be developed in specialized units for subspecialization in transplantation or vascular surgery which trainees can compete for at the end of their training.

All trainees would be encouraged to spend time completing a research project; however, trainees aiming to pursue an academic career will be expected to spend time between the basic and advanced training to compete a postgraduate degree such as Masters, MD or PhD.

The curriculum to be completed within this time frame will be based on a modular structure covering Anatomy and Pathophysiology of Cardiac System, Cardiopulmonary Bypass, Anatomy and Pathophysiology of Respiratory System, Anatomy and Pathophysiology of Congenital Heart Disease, Cardiothoracic Intensive Care, Ischaemic Heart Disease, Valvular Heart Disease, Pericardial Disease, Lung Cancer, Pleural Disease, Emphysema and Bullae, Mediastinal Disease, Aortovascular Disease, Oesophageal Disease, and Chest Wall and Diaphragm and Transplantation modules delivered in a spiral method [22], with an increasing depth and complexity as they are revisited at higher levels of training.

METHODS OF DELIVERY

The training programme will be designed and delivered by cardiothoracic surgery departments along the lines of the proposed curriculum and training structure. Each training programme will have an assigned Programme Director in overall charge of the delivery of the training. Each trainee in the programme will have an assigned Educational Supervisor to directly supervise and facilitate their training. The Educational Supervisors will be selected by the Programme Director and are expected to have completed Training the Trainer and Competence-Based Assessment Courses.

These training programmes will gain accreditation from the European Cardiothoracic Surgery Training Board. This could either be under the auspices of the European Association for Cardiothoracic Surgery, the European Union of Medical Specialists (UEMS) or the European Board of Thoracic and Cardiovascular Surgery. It will be responsible for review and accreditation of the training programmes across the European Union. It will also be responsible for issuing the Certificate of Completion of Basic Cardiothoracic Training and the European Certificate of Completion of Cardiothoracic Training in the chosen subspecialty. The Training Board will issue the Certificates of training on the recommendation of the Training Programme Directors and the provision of evidence of achieving the competence required.

ASSESSMENT OF COMPETENCE

The competencies required for each stage of the curriculum will be assessed by the Educational Supervisor of the trainee and signed off once achieved by the Supervisor and the Programme Director.

Competence-based assessment can be work-based assessment used to determine the successful completion of each module by demonstrating competence in knowledge, skills and abilities prescribed in the curriculum. Tools commonly used for competence assessment include Clinical Evaluation Exercises, Case-based Discussions, Multi Source Feedback, Direct Observations of Procedural Skills and Procedure-based Assessments. However, the data for validation of Procedure-based Assessment tools used in the work place remains lacking and this led Kogan *et al.* [23] to conclude that 'although many tools are available for the direct observation of clinical skills, validity evidence and description of educational outcomes are scarce'. Furthermore, Miller and Archer [24] in a systemic review on the impact of workplace-based assessment on doctors' education and performance concluded that 'considering the emphasis placed on workplace based assessment as a method of formative performance assessment, there are few published articles exploring its impact on doctors' education and performance'. They, however, found evidence to show 'that multisource feedback can lead to performance improvement, although individual factors, the context of the feedback, and the presence of facilitation have a profound effect on the response.' They found that 'there is no evidence that alternative workplace based assessment tools (mini-clinical evaluation exercise, direct observation of procedural skills, and case based discussion) lead to improvement in performance, although subjective reports on their educational impact are positive'.

These tools of competence suffer from a fundamental issue which is over-reliance on the use of checklists for their assessment; this has been demonstrated to be inferior to global assessment by experienced observers in Objective Structured Assessment of Technical Skills [25]. The global rating scale, which includes five to eight surgical behaviours such as respect for tissues, economy of motion and appropriate use of assistants, was more reliable and valid. The final assessment of competence and achievement of targets would arguably in this European training programme have to have greater emphasis placed on global judgements of experienced trained trainers.

CONCLUSIONS

The establishment of a coherent and uniform European training programme in cardiothoracic surgery is overdue and will aid in the exchange of information, knowledge, technology and skills across Europe. It will allow increased trust and transparency in training of all European trainees and improves public confidence of the training process to produce fully trained competent surgeons.

Conflict of interest: none declared.

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EDITORIAL COMMENT

Time to end the disparity of training in Europe

Leslie Hamilton*

Department of Cardiothoracic Surgery, Freeman Hospital, Newcastle upon Tyne, UK

* Corresponding author. Department of Cardiothoracic Surgery, Freeman Hospital, Newcastle upon Tyne NE7 7DN, UK. Tel: +44-191-2137309; e-mail: leslie.hamilton@nuth.nhs.uk (L. Hamilton).

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Free movement of people (and so workers) is one of the four economic freedoms guaranteed under the internal market of the European Union (the others being goods, capital and services). It is a fundamental principle of European Law that each of the 27 member states must recognize professional qualifications granted in another country. The details relating to this mutual recognition are set out in the Directive 93/16/EEC of 5 April 1993.

This only makes sense if we have a common training programme which produces surgeons with equivalent knowledge and skills. Yet, we all know that there are marked variations, not only in the content and delivery of training but also in the selection, assessment and accreditation of trainees. The current situation is nonsensical.

The paper, published in this issue, by Loubani *et al*. [1] is a valuable contribution to the debate which we must have if we are to make any progress towards harmonization of training. The authors rightly compare the organization of training in other countries with the wide variation in Europe. The practice of cardiothoracic surgery is evolving rapidly with a significant move towards subspecialization (to the benefit of patients who must remain our key focus), and so, the way we train the next generation must change. They make a good argument for a modular-based system with an initial broad-based 'basic' programme with later specialization.

As things stand at present, the UEMS (Union Européenne des Médecins Spécialistes) is the representative organization of all medical specialists in the EC [2]. As it is the legal entity, we must work through UEMS. A 'European Board' is a body set up by the relevant UEMS/Specialized Section with the purpose of guaranteeing the highest standards of care in the speciality concerned in the EC member states by ensuring that the training of specialists is raised to an adequate level.

This might seem to be a rather unwieldy and bureaucratic system, but it is the only mechanism we have to work with. I believe it is something the National Societies can use to work